

A New Awareness: Probiotic, Prebiotic and Microbiota Knowledge and Attitude of Obstetricians

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ABSTRACT

OBJECTIVE: In this study, we aimed to investigate the knowledge and attitudes of obstetricians about probiotics, prebiotics, and microbiota and evaluate the differences by years in the profession.

STUDY DESIGN: This cross-sectional study was conducted on obstetricians working in a tertiary center. A non-validated questionnaire consisting of 18 questions was collected face-to-face. The first part of the questionnaire evaluated the sociodemographic data and the duration of the profession, the other parts assessed the knowledge of prebiotic, probiotic, and microbiota of obstetricians and their attitudes toward prescribing or suggesting these supplements. Furthermore, the obstetricians were divided into two groups: those with a profession less than <12 years and ≥12 years according to the median value of the whole study group to assess the impact of the experience.

RESULTS: There was a statistically significant difference between obstetricians with a profession of < 12 years and ≥12 years in their self-knowledge assessment of probiotics, prebiotics, and microbiota. However, the correct definitions were chosen at similar rates. Only 40% of obstetricians with a <12 years of profession thought the use of probiotics during pregnancy to be safe, while more than two-thirds of the obstetricians with a profession of ≥12 years found it safe. Additionally, significant differences were found between the groups' sources of information, and the purpose of recommendation.

CONCLUSIONS: The knowledge and attitude of obstetricians towards probiotics, prebiotics, and microbiota may be affected by the duration of the profession.

Keywords: Microbiota, Obstetricians, Prebiotic, Probiotic

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Introduction

The use of probiotics and prebiotics is becoming more trend and common as the awareness of these supplements increases (1). Probiotics are live microbial supplements that im-

prove the host's health. Prebiotics are substrates that induce the growth of beneficial microorganisms in the host (2). Microbiota is the commensal and mutual living microorganism in our body and is well associated with human health (3).

The effect of probiotics and prebiotics have been studied mostly in the field of pediatrics (4,5) and gastroenterology (6,7). On the other hand, a few studies have been conducted in the field of obstetrics and gynecology such as the effect of these supplements in preventing gestational diabetes, postpartum depression, and bacterial vaginosis (8-11). The vaginal microbiome has been evaluated in patients with spontaneous abortion (12). The safety of probiotics and prebiotics during gestation was also evaluated (13).

In a recent international study, the knowledge of probiotics has been questioned by healthcare professionals via the internet (14). Additionally, in another study, medical science students and practitioners were assessed for the perception of probiotics (15). However, nowadays, our knowledge about the attitudes of obstetricians towards probiotics and prebiotics is still limited. In this study, we aimed to investigate the knowledge of obstetricians about this trending topic and attract attention.

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Materials and Method

This study was approved by the institutional ethics committee (02/03/2022-E2-22-1436). Informed consent was obtained from all participants. The data of the questionnaire was collected face to face by an obstetrician (D.T.E). The current study was conducted on expert obstetricians working in a tertiary center.

This study, which evaluated the prebiotic, probiotic, and microbiota knowledge of obstetricians and gynecologists, consisted of 18 questions in total. The previous studies have examined the knowledge of different types of health professions such as pharmacists, but we aimed to examine the knowledge of the obstetricians and their attitudes and to examine the current use of these alternative biotherapeutics during high-risk and normal pregnancies which were not studied before. Therefore, a non-validated questionnaire was used for more detailed inquiry in the present study considering previous studies (13,14).

Whereas the first part of this questionnaire evaluated the sociodemographic data such as age, body height, and weight, body mass index (BMI), gender, and the duration of profession in years, the other questions assessed the knowledge of prebiotic, probiotic, and microbiota of obstetricians and the attitudes of them to prescribe or suggest these supplements. As for the self-assessment of knowledge, 1 point was given to no knowledge (none), 2 points were given to insufficient knowledge, 3 points were given to intermediate knowledge, 4 points were given to sufficient knowledge, and 5 points were given to excellent knowledge. Furthermore, the obstetricians were divided into two groups as those with a profession less than <12 years and those with a profession \geq 12 years according to the median value of the whole study group to assess the impact of experience on the choice of probiotics and prebiotics in their daily practice.

Statistical analysis

In order to analyze the data Statistical Package for the Social Sciences (SPSS) 24 program was used. The conformity of the data to the normal distribution was evaluated by the

Kolmogorov-Smirnov test and Shapiro-Wilk test. Non-parametric methods were used for the analysis of the non-normal distributed data. Mann-Whitney U test and Chi-square tests were used to compare the groups. Non-normally distributed data were shown as median (min-max). Categorical data was shown in numbers (n) and percentages (%). Values with a *p*-value less than 0.05 were considered as significant.

Results

This study was applied to a total of 110 obstetricians working for the same tertiary center. The sociodemographic data were given in table I. Whereas 57.3% of the obstetricians were women, 42.7% were men. The median age of the obstetricians was 36 (28-63). In addition, the median duration of profession was 12 years (4-36). The obstetricians were divided into two groups as those with a profession less than <12 years and \geq 12 years.

In table II, the groups were compared as to their knowledge of probiotics, prebiotics, and microbiota. There was a statistically significant difference between the groups ($p=0.001$). Most of the obstetricians with a profession of less than 12 years reported their knowledge of probiotics and prebiotics as intermediate (54.5%) or insufficient (32.7%). On the other hand, whereas obstetricians with a profession \geq 12 years reported a higher rate of excellent knowledge (20%), those with a profession less than <12 years did not report an excellent rate of knowledge. However, as to the true definition of probiotics, the correct definition (answer b) was chosen by 81.8% of obstetricians with a profession less than <12 years and 76.4% of the obstetricians with a profession \geq 12 years. Additionally, no statistically significant difference was found between the groups in terms of the correct definition of prebiotics (answer b) ($p=0.168$). Although there was a statistically significant difference in the self-assessment level of knowledge about microbiota between the groups ($p=0.002$), the correct definition of microbiota (answer yes) did not differ between the groups ($p=0.243$).

The obstetricians were questioned whether they had ever used probiotics themselves, it was found that more than half of

Table I: Sociodemographic characteristics of the obstetricians

Variable	Obstetricians (n=110)
Age (years)	36 (28-63)
Gender	Women 63 (57.3) Men 47 (42.7)
Duration of Profession (years)	12 (4-36)
Weight (kg)	74 (48-108)
Height (cm)	168,50 (160-190)
BMI (kg/m ²)	24.4 (17.9-38.7)

Values were given as median [min-max], number (%). BMI: Body Mass Index

both groups used it ($p=0.563$). Although both groups reported that they obtained probiotics from the pharmacy most frequently, obstetricians with a profession of less than <12 years stated that they obtained probiotic usage information from the internet more frequently than the other group. Furthermore, they did not obtain information from the newspaper. Whereas 70.9% of the obstetricians with a profession ≥ 12 years reported that they recommend probiotics and find them safe to use during pregnancy, obstetricians with a profession <12 years had more concerns as to the safety of probiotics during pregnancy ($p=0.001$). Obstetricians with a profession ≥ 12 years were observed to recommend probiotics more fre-

quently for gastrointestinal tract complaints. All of the obstetricians with a profession <12 years, recommended probiotics in the treatment of vaginal infections during pregnancy ($p=0.003$). In addition, both groups reported a high rate, they recommended homemade natural foods while providing nutritional counseling (Table III).

The groups agreed that babies born vaginally have a more diverse microbiota. Additionally, in table IV, the relationship between microbiota and antibiotics was questioned. No statistically significant difference was found in the attitude and approach of obstetricians about microbiota and antibiotics.

Table II: Knowledge of probiotics, prebiotics, and microbiota

Variables	Obstetricians with a profession <12 years (n=55)	Obstetricians with a profession ≥ 12 years (n=55)	<i>p</i>
What is your level of knowledge about probiotics and prebiotics?			0.001
Excellent	0 (0%)	11 (20%)	
Sufficient	6 (10.9%)	8 (14.5%)	
Intermediate	30 (54.5%)	17 (30.9%)	
Insufficient	18 (32.7%)	14 (25.5%)	
None	1 (1.9%)	5 (9.1%)	
Which of the following is the correct definition of probiotics?			0.621
a) Probiotics are dead organisms that benefit the host when administered in sufficient quantities.	4 (7.3%)	4 (7.3%)	
b) Probiotics are live organisms that benefit the host when administered in sufficient quantities.	45 (81.8%)	42 (76.4%)	
c) Probiotics are all microorganisms consumed with foods and dietary supplements.	4 (7.3%)	8 (14.5%)	
d) I do not know the definition of probiotics	2 (3.6%)	1 (1.8%)	
Which of the following is the correct definition of prebiotic?			0.168
a) Prebiotics are dead microorganisms that benefit the host when administered in sufficient quantities.	10 (18.2%)	6 (10.9%)	
b) Prebiotics are compounds that induce the growth and activity of beneficial microorganisms such as bacteria and fungi.	34 (61.8%)	33 (60.0%)	
c) Prebiotics are live microorganisms that benefit the host when administered in sufficient quantities.	11 (20.0%)	12 (21.8%)	
d) I do not know the definition of probiotics	0 (0.0%)	4 (7.3%)	
What is your level of knowledge about microbiota?			0.002
Excellent	0 (0.0%)	7 (12.7%)	
Sufficient	4 (7.3%)	11 (20.0%)	
Intermediate	27 (49.1%)	13 (23.6%)	
Insufficient	12 (21.8%)	16 (29.1%)	
None	12 (21.8%)	8 (14.5%)	
Microbiota is all organisms that live in our body in a commensal and mutual way.			0.243
(n, %)			
Yes	55 (100%)	52 (94.5%)	
No	0 (0.0%)	3 (5.5%)	

Values were given as numbers (%). $p < 0.05$ was considered statistically significant

Table III: Attitudes of obstetricians towards probiotics, prebiotics, source of information, recommendation, and safety during pregnancy

Variables	Obstetricians with a profession <12 years (n=55)	Obstetricians with a profession ≥12 years (n=55)	p
Have you ever used probiotics yourself?			0.563
Yes	33 (60%)	30 (54.5%)	
No	22 (40%)	25 (45.5%)	
Where did you get the probiotics?			0.666
Supermarket/Internet	7 (21.2%)	10 (31.2%)	
Pharmacy	19 (57.6%)	16 (50%)	
Homemade	7 (21.2%)	6 (18.8%)	
Where did you get the information about the use of probiotics?			0.048
Newspaper	0 (0%)	7 (12.7%)	
Medical doctor	20 (36.4%)	18 (32.7%)	
Pharmacy	0 (0%)	0 (0%)	
Internet	33 (60.0%)	27 (49.1%)	
Television / Radio	2 (3.6%)	3 (5.5%)	
Do you recommend probiotics and find them safe to use during pregnancy? (n,%)			0.001
Yes	22 (40%)	39 (70.9%)	
No	33 (60%)	16 (29.1%)	
For what purposes do you recommend probiotics in pregnant women?			0.006
Gastrointestinal tract symptoms*	7 (12.7%)	19 (34.5%)	
Flora regulator	10 (18.2%)	16 (29.1%)	
Immunity	5 (9.1%)	3 (5.5%)	
Do you think probiotics should be used in high-risk pregnancies such as gestational diabetes, preeclampsia, hypertension, preterm labor, and intrauterine growth restriction? (n,%)			0.444
Yes	32 (58.2%)	28 (50.9%)	
No	23 (41.8%)	27 (49.1%)	
Can probiotics be recommended in the treatment of vaginal infections during pregnancy? (n,%)			0.003
Yes	55 (100%)	47 (85.5%)	
No	0 (0%)	8 (14.5%)	
Do you recommend homemade natural foods (tarhana, pickles, kefir, yoghurt, etc.) when giving nutritional counseling during pregnancy? (n,%)			0.093
Yes	50 (90.9%)	54 (98.2%)	
No	5 (9.1%)	1 (1.8%)	
Have you ever had a patient who used/prescribed probiotics during pregnancy?			0.085
Yes	21 (38.2%)	30 (54.5%)	
No	34 (61.8%)	25 (45.5%)	

Values were given as numbers (%). Internet*: Gastrointestinal tract symptoms*: Diarrhea, constipation, vomiting and nausea, abdominal discomfort, acid reflux. $p < 0.05$ was considered statistically significant.

Table IV: The relationship between microbiota and antibiotics

Variables	Obstetricians with a profession <12 years (n=55)	Obstetricians with a profession ≥12 years (n=55)	<i>p</i>
In which way is the microbiota more diverse in babies born? (n,%)			0.647
Vaginal	52 (94.5%)	53 (96.4%)	
Cesarean section	3 (5.5%)	2 (3.6%)	
Should babies born by cesarean section be given probiotics? (n,%)			0.319
Yes	22 (40%)	17 (30.9%)	
No	33 (60%)	38 (69.1%)	
Would you recommend probiotics to reduce antibiotic side effects during pregnancy? (n,%)			0.445
Yes	31 (56.4%)	27 (49.1%)	
No	24 (43.6%)	28 (50.9%)	
Do you think the antibiotics administered to the mother affect the infant's microbiota? (n,%)			0.541
Yes	50 (90.9%)	48 (87.3%)	
No	5 (9.1%)	7 (12.7%)	

Values were given as numbers (%). $p < 0.05$ was considered statistically significant.

Discussion

This present study investigated obstetricians' knowledge and attitudes towards probiotics, prebiotics, and microbiota and evaluated differences by years in the profession. The findings of this study indicated that, although there was a statistically significant difference between obstetricians with a profession of <12 years and ≥12 years in their self-knowledge assessment of probiotics, prebiotics, and microbiota, both groups have chosen the correct definitions at similar rates. Additionally, the groups had similar attitudes and recommendations regarding their use of probiotics, use in high-risk pregnancies, nutritional counseling of homemade natural foods, and the relationship between microbiota and antibiotics. However, there were significant differences between the groups as to the source of information, finding these biotherapeutics safe to use during pregnancy, and the purpose of recommendation during pregnancy.

In our study, most obstetricians assessed their self-knowledge of probiotics and prebiotics as in an intermediate state. Whereas 1 in 5 of the obstetricians with a profession ≥12 years thought that they had excellent knowledge, no one in the group of obstetricians with a profession <12 years thought they had excellent knowledge of probiotics and prebiotics and microbiota. However, our study also showed that over three-quarters of the obstetricians gave the correct answer to the definition of probiotics. Additionally, almost two-thirds of the obstetricians gave the correct answer for the prebiotic definition, and more than 90% of the obstetricians gave the correct answer for the definition of microbiota. On the other hand, in

a study conducted in 2019, as to self-assessment pediatricians were found to report their knowledge at a higher level (16). Similar to that study, Johnson et al. reported that 85% of medical doctors have a good knowledge of probiotics (17). This difference may also be due to the fact that these studies were conducted online and our study was made face to face. In addition, the obstetricians in our current study could be more self-critical as working in the field of obstetrics in a referred center have more medicolegal problems.

In this study, 60% of the obstetricians with a profession <12 years and almost half of the obstetricians with a profession ≥12 years were shown to use the internet as a source of information. Scientific articles and books downloaded from the Internet, online lectures, and online conferences as a source were also included in Internet choice in our study. Additionally, while 12.7% of the experienced obstetricians used newspapers as a source of information for probiotics, none of the obstetricians with a profession <12 years used it. Although the sources of obtaining information differed between the two groups in our study ($p=0.048$), no statistically significant was found as to correct definitions of probiotics, prebiotics, and microbiota. Studies have shown that there is a desire and need to obtain more reliable information about these products (15). Although the main sources of information were affected by the cultural and economic conditions of the countries, similar to our study Internet was reported to be used more frequently (18,19). To our knowledge, there is no microbiota, probiotic or prebiotic lecture during the residency training program process and also during medical schools as to the role of these biotherapeutics to be used as a medication.

On the other hand, we believe that providing evidence-based information and including it in the education program may change the attitudes of obstetricians towards alternative biotherapeutics such as probiotics and prebiotics.

The safety of probiotics and prebiotics during pregnancy has been studied so lately (20). Although there is uncertainty, a systematic review reported that 26% of the studies stated no adverse effects of these products (13). On the other hand, in our study, whereas only 40% of obstetricians with a <12 years of profession thought the use of probiotics during pregnancy to be safe, more than two-thirds of the obstetricians with a profession of more than 12 years found probiotics safe to be used during pregnancy. The difference between the groups may depend on the previous experiences and the fact that they may have seen no side effects as the years in the profession increased. Moreover, obstetricians with a profession of less than 12 years may have found the use of probiotics more unsafe due to the information pollution that can be found on the Internet. Gastrointestinal complaints have increased due to the widespread use of antibiotics and associated side effects on the gut microbiota (21). And, as expected, in this current study experienced obstetricians recommended probiotics more during pregnancy, most frequently for gastrointestinal tract symptoms and flora regulators, respectively in line with the previous studies (19).

In the literature, there are studies showing confusion about whether yogurt and fermented products normally contain probiotics, and that it is thought to be used only in the form of tablets or capsules (17). However, in our study, almost all of the obstetricians recommended tarhana, pickles, kefir, yogurt, and similar products while giving nutritional counseling during pregnancy. Furthermore, probiotics and prebiotics cannot be prescribed in our country. Patients can purchase these products at their own expense. Perhaps because of this reason, there is more tendency towards natural products.

One strength of our study is its novelty. To our knowledge, this is the first study to evaluate the knowledge and attitudes of obstetricians toward prebiotics, probiotics, and microbiota. Additionally, it is a prospective cross-sectional study and it was collected face-to-face. However, the limitation of the study is that it was conducted in a single center and therefore a relatively low number of cases (n=110). We used a non-validated questionnaire. This may have led to inadequacy in the distribution of questions and contradictory results. Additionally, there was no question in our study about medical meetings as the origin of the knowledge. This can be thought of as a limitation. However, medical meetings have been held online in our country for approximately 3 years during the pandemic process and we evaluated online sources under the Internet choice.

In conclusion, we think this trending topic is still a mystery for obstetrics. The knowledge and attitude of obstetricians

towards these alternative biotherapeutics may be affected by the duration of the profession and the source of information. Further studies and evidence-based scientific education are needed to clarify the place of prebiotics, probiotics, and microbiota in the obstetric field of clinical use.

Declarations

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Ethics approval and Informed Consent: This study was approved by the institutional ethics committee (02/03/2022-E2-22-1436). All participants gave written informed consent after they were informed about the study. The study was conducted in accordance with the Declaration of Helsinki

Conflict of interest: No conflict of interest.

Availability of data and materials: The data that support the findings of this study are available on request from the corresponding author.

Authors' contributions: Concept: DTE, OK, AT. Design: DTE, BE, AT. Supervision: OK, DS. Resource: DTE, BE, DMB. Data collection/Processing: DTE, BE, DMB. Analysis/ Interpretation: DTE, AT, BE. Literature search: DTE, OK, DMB. Writing: DTE, DMB, AT, DS. Critical Reviews: OK, AT, DS.

All authors read and approved the final version of the manuscript.

References

1. Cunningham M, Azcarate-Peril MA, Barnard A, Benoit V, Grimaldi R, Guyonnet D., et al. Shaping the future of probiotics and prebiotics. *Trends Microbiol.* 2021; 29(8): 667-85. Doi: 10.1016/j.tim.2021.01.003. PMID: 33551269.
2. Swanson KS, Gibson GR, Hutkins R, Reimer RA, Reid G, Verbeke K, et al. The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of synbiotics. *Nat Rev Gastroenterol Hepatol.* 2020;17(11):687-701. Doi: 10.1038/s41575-020-0344-2. PMID: 32826966, PMCID: PMC7581511.
3. Jandhyala SM, Talukdar R, Subramanyam C, Vuyyuru H, Sasikala M, Reddy DN. Role of the normal gut microbiota. *World J Gastroenterol.* 2015;21(29):8787. Doi: 10.3748/wjg.v21.i29.8787. PMID: 26269668, PMCID: PMC4528021.
4. Depoorter L, Vandenplas Y. Probiotics in Pediatrics. A Review and Practical Guide. *Nutrients.* 2021;13(7):2176. Doi: 10.3390/nu13072176. PMID: 34202742, PMCID: PMC8308463.
5. Asha MZ, Khalil SF. Efficacy and safety of probiotics, prebiotics and synbiotics in the treatment of irritable bowel syndrome: A systematic review and meta-analysis. *Sultan Qaboos Univ Med J.* 2020;20(1):e13. Doi: 10.18295/squmj.2020.20.01.003. PMID: 32190365, PMCID: PMC7065695.

6. Quigley EM. Prebiotics and probiotics in digestive health. *Clinical Gastroenterol Hepatol*. 2019;17(2):333-44. Doi: 10.1016/j.cgh.2018.09.028. PMID: 30267869.
7. Simon E, Călinoiu LF, Mitrea L, Vodnar DC. Probiotics, prebiotics, and synbiotics: Implications and beneficial effects against irritable bowel syndrome. *Nutrients*. 2021;13(6):2112. Doi: 10.3390/nu13062112. PMID: 34203002, PMCID: PMC8233736
8. Xiaoqian C, Jiang X, Huang X, Honggu H, Zheng J. Association between probiotic yogurt intake and gestational diabetes mellitus: a case-control study. *Iran J Public Health*. 2019;48(7):1248-56. Doi: 10.18502/ijph.v48i7.2946. PMID: 31497545, PMCID: PMC6708537.
9. Slykerman RF, Hood F, Wickens K, Thompson JMD, Barthow C, Murphy R, et al. Effect of *Lactobacillus rhamnosus* HN001 in pregnancy on postpartum symptoms of depression and anxiety: a randomised double-blind placebo-controlled trial. *EBioMedicine*. 2017;24:159-65. Doi: 10.1016/j.ebiom.2017.09.013. PMID: 28943228, PMCID: PMC5652021.
10. Parma M, Vanni VS, Bertini M, Candiani M. Probiotics in the prevention of recurrences of bacterial vaginosis. *Altern Ther Health Med*. 2014;20 Suppl 1:52-7. PMID: 24473986.
11. Freire AD, Custódio AI, Queiroz Filho J, Freitas JC, Gonçalves AK, Cobucci RN. The association between abnormal vaginal flora and cytological evidence of HPV with prematurity in high-risk pregnant women. *Gynecol Obstet Reprod Med*. 2020;26(3):173-8. Doi: 10.21613/GORM.2019.928.
12. Emele FE, Onyeulor P, Nwaokorie F, Asogwa D. Analysis of vaginal microbiome in women with or without episodes of spontaneous abortion in Eastern Nigeria. *Gynecol Obstet Reprod Med*. 2022;1-9. Doi: 10.21613/GORM.2022.1297.
13. Sheyhollisami H, Connor KL. Are probiotics and prebiotics safe for use during pregnancy and lactation? A systematic review and meta-analysis. *Nutrients*. 2021; 13(7):2382. Doi: 10.3390/nu13072382. PMID: 34371892, PMCID: PMC8308823.
14. Fijan S, Frauwallner A, Varga L, Langerholc T, Rogelj I, Lorber M, et al. Health professionals' knowledge of probiotics: an international survey. *Int J Environ Res Public Health*. 2019;16(17):3128. Doi: 10.3390/ijerph16173128. PMID: 31466273, PMCID: PMC6747149.
15. Chukwu EE, Nwaokorie FO, Yisau JI, Coker AO. Assessment of the knowledge and perception of probiotics among medical science students and practitioners in Lagos state. *British J Medicine Medical Res*. 2015;5 (10):1239. Doi: 10.9734/BJMMR/2015/13676.
16. Pettoello-Mantovani M, Çullu Çokuğraş F, Vural M, Mestrovic J, Nigri L, Piazzolla R, et al. Pilot study for the understanding and use of probiotics by different paediatric healthcare professionals working in different European countries. *Ital J Pediatr*. 2019;45(1):57. Doi: 10.1186/s13052-019-0648-4. PMID: 31053146, PMCID: PMC6498681.
17. Johnson N, Thomas L, Jordan D. Probiotics: assessing health professionals' knowledge and understanding. *Gastrointestinal Nursing*. 2016;14(1):26-33. Doi: 10.12968/GASN.2016.14.1.26
18. Prince AC, Moosa A, Lomer MC, Reidlinger DP, Whelan K. Variable access to quality nutrition information regarding inflammatory bowel disease: a survey of patients and health professionals and objective examination of written information. *Health Expect*. 2015;18(6):2501-12. Doi: 10.1111/hex.12219. PMID: 24934409, PMCID: PMC5810632.
19. Havelda L, Bencz Z, Veresné Bálint M. Knowledge, awareness, and usage of probiotics among Hungarian adults: An explorative survey. *Developments in Health Sciences*. 2021;3(3):53-7. Doi: 10.1556/2066.2020.00010.
20. Baldassarre ME, Palladino V, Amoruso A, Pindinelli S, Mastromarino P, Fanelli M, Di Mauro A, Laforgia N. Rationale of probiotic supplementation during pregnancy and neonatal period. *Nutrients*. 2018;10(11):1693. Doi: 10.3390/nu10111693. PMID: 30404227, PMCID: PMC6267579.
21. Patangia DV, Anthony Ryan C, Dempsey E, Paul Ross R, Stanton C. Impact of antibiotics on the human microbiome and consequences for host health. *MicrobiologyOpen*. 2022;11(1):e1260. Doi: 10.1002/mbo3.1260. PMID: 35212478, PMCID: PMC8756738.